University of Verona,
School of Exercise and Sport Science,
Laurea magistrale in Scienze motorie preventive ed adattate

Metodologia delle misure delle attività sportive

Monday 14/12/2015 h. 13:30÷15

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A class within a six classes module

59

Accelerometers

Actiwatch  -> Actical 

Actitrac 

Biotrainer 

Accelerometers

Nokia N79

Carlson Jr et al., 2012

Accelerometers

measures

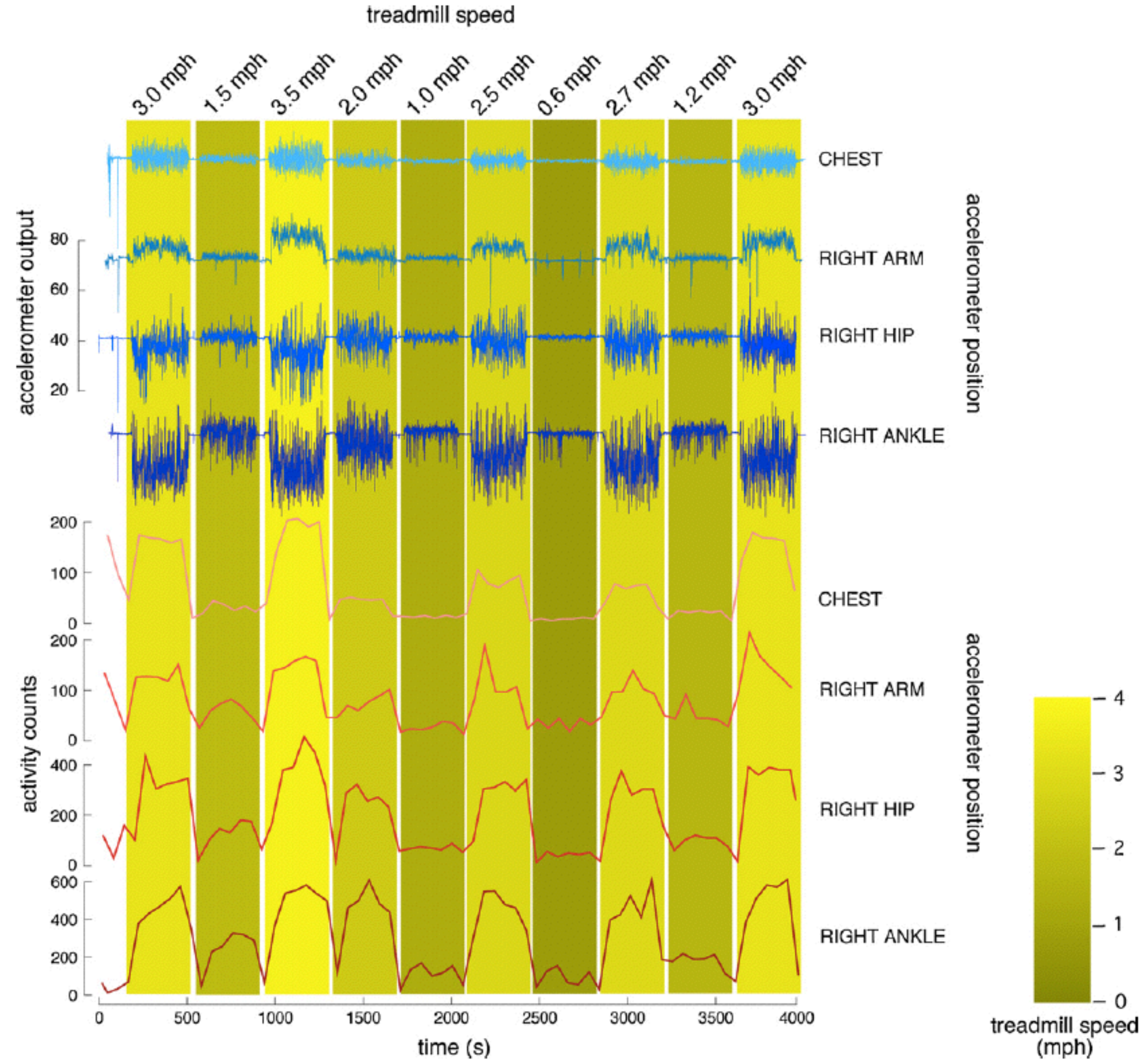

Fig. 1. Activity counts from cell-phone accelerometers provide an accurate measure of treadmill gait speed regardless of where the sensor is worn. The top four traces depict raw data from a representative trial (43 y/o man) showing acceleration magnitude *versus* time for sensors worn at the chest, right arm, right hip, and right ankle (1st through 4th traces from top, respectively). For all traces the baseline is centered at 64 (midscale between sensor output of 0 for −2 g, and 128 for +2 g), the amount of deflection from this baseline is per the common scale provided left of these traces. The bottom four traces show activity counts *versus* time for the sensors worn at the chest, right arm, right hip, and right ankle, respectively. Counts were calculated over 1 min nonoverlapping bins. Treadmill speed is given at the top of each epoch bar.

Accelerometers

measures

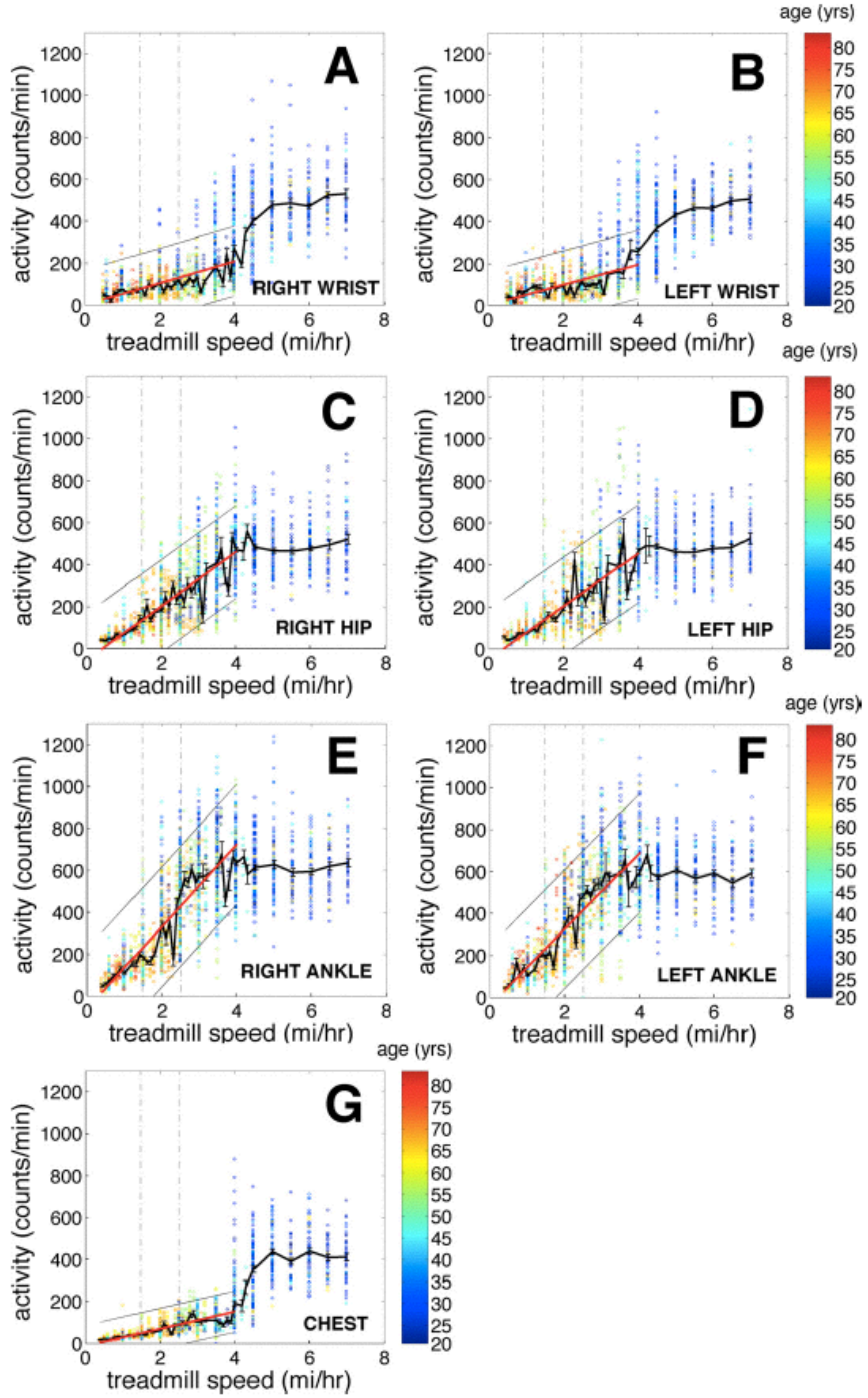

Fig. 3. Activity count versus treadmill speed relationships for all sensor locations. For all figures, the solid red line shows the linear regression between treadmill speed and activity counts (fit for all data between 0.0 and 6.4 km/h (0–4 mi/h) gait speeds); the thin surrounding black lines are 95% confidence boundaries on this regression. The thick black line connects mean activity count values for each of the evaluated treadmill speeds; bars surrounding this point are ±1 standard error of the mean. Individual observations of activity counts are shown as open colored circles. Subject age is color coded as circle color; refer to colorbar at right side for key. The dashed lines at gait speeds of 2.35 km/h (1.46 mi/h) and 4 km/h (2.5 mi/h) highlight system performance at two critical functional thresholds. These relationships come from cell phones placed at the right wrist (A), left wrist (B), right hip (C), left hip (D), right ankle (E), left ankle (F), and neck (G).

Accelerometers

Apple iPod Touch
(iPhone)

Ellis et al., 2015

Accelerometers

measures

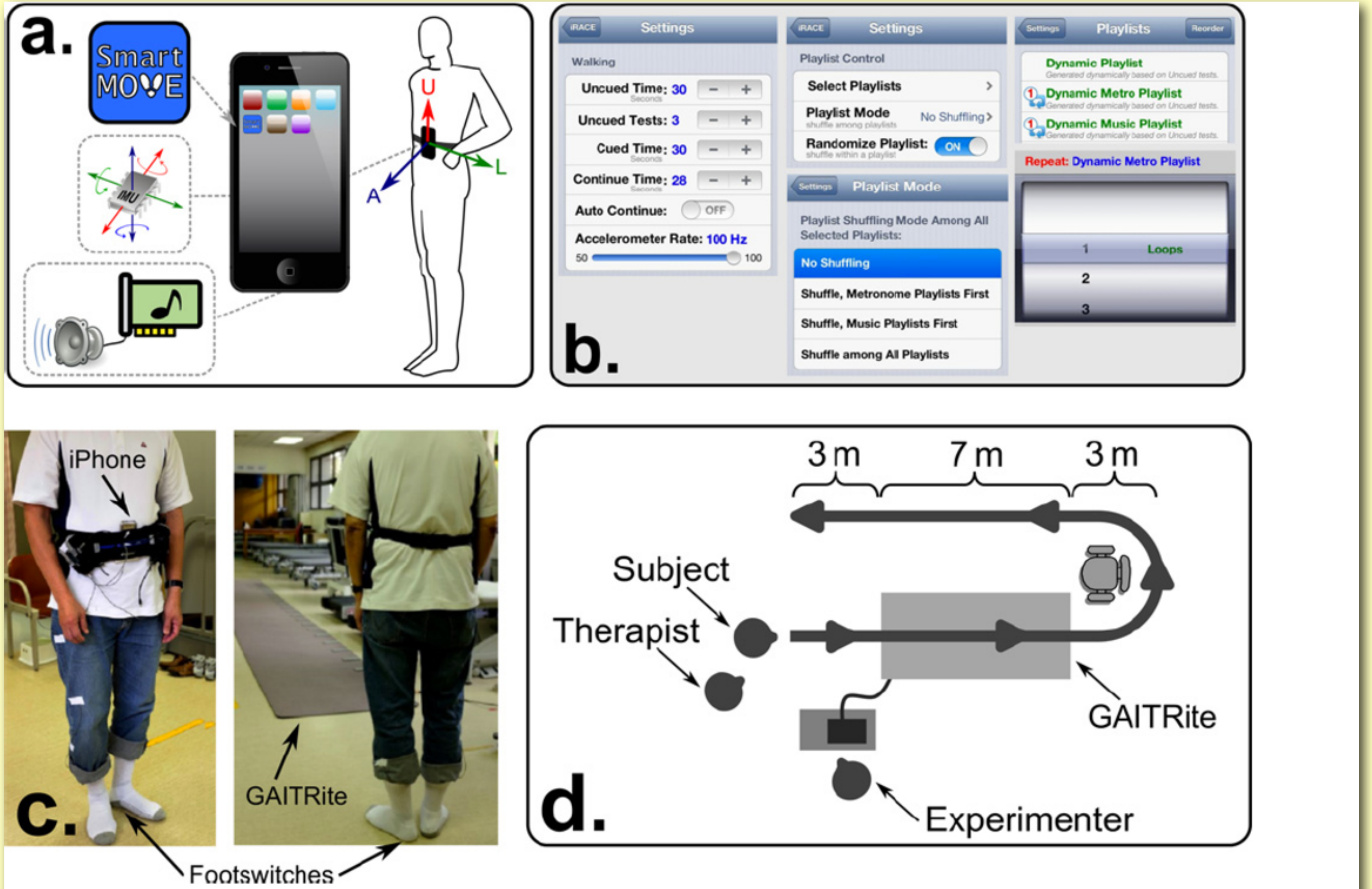

Fig 1. Key experimental features. The SmartMOVE mobile app (a.) utilizes the smartphone's inertial measurement unit to record gait movements during walking. Flexible parameter settings (b.) enable precise control over testing parameters. SmartMOVE outcome measures were validated against heel-mounted footswitches and a GAITRite sensor walkway (c.) while subjects walked along a prescribed path (d.).

Accelerometers

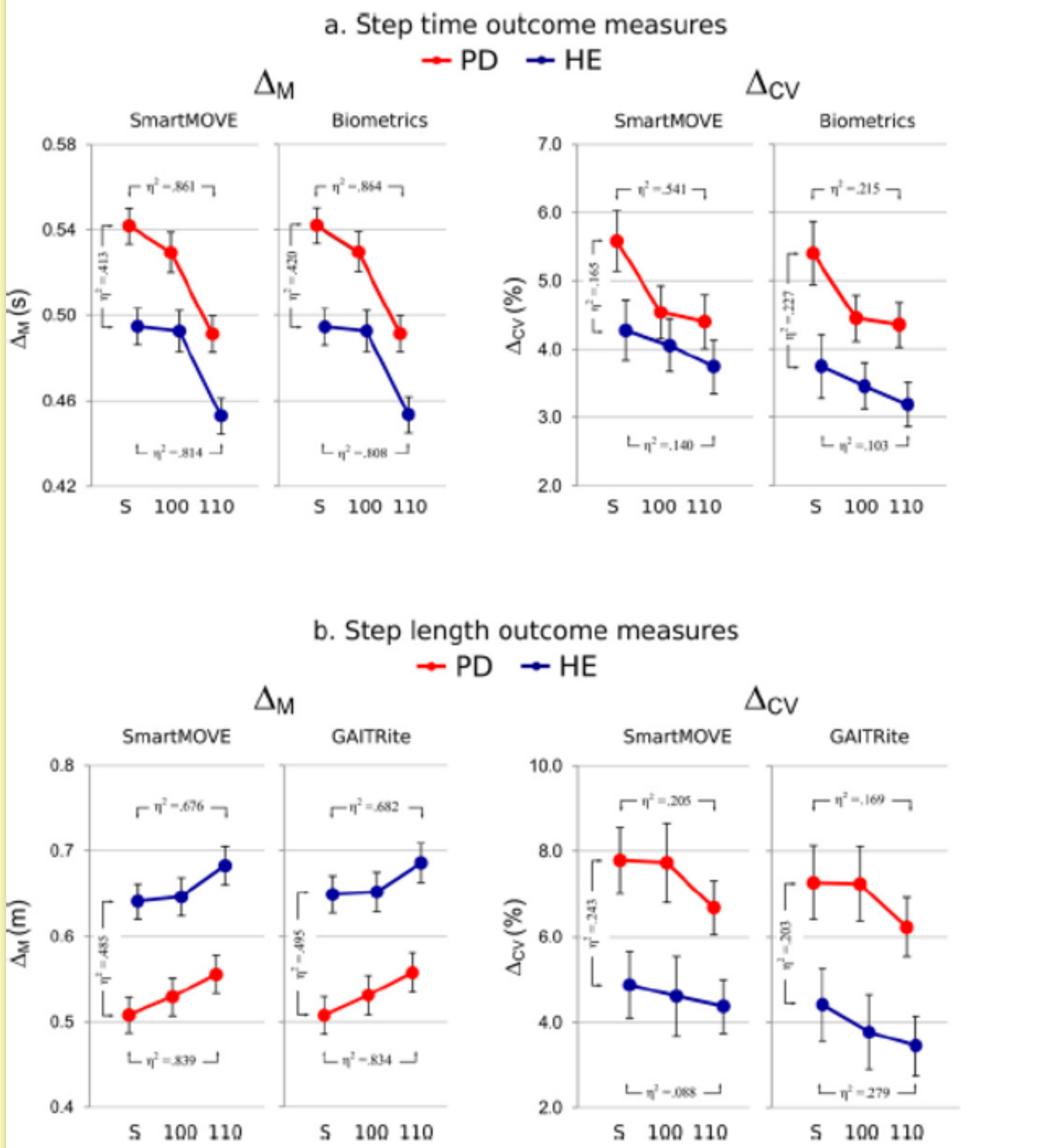

Fig 2. Outcome measure results. Results of the *Group* (separate lines: PD vs. HE) × *Condition* (x-axis: self-paced, 100% RAC, 110% RAC) × *Device* (separate panels: SmartMOVE vs. heel contact–based) ANOVAs for step time (a.) and step length (b.) outcome measures.

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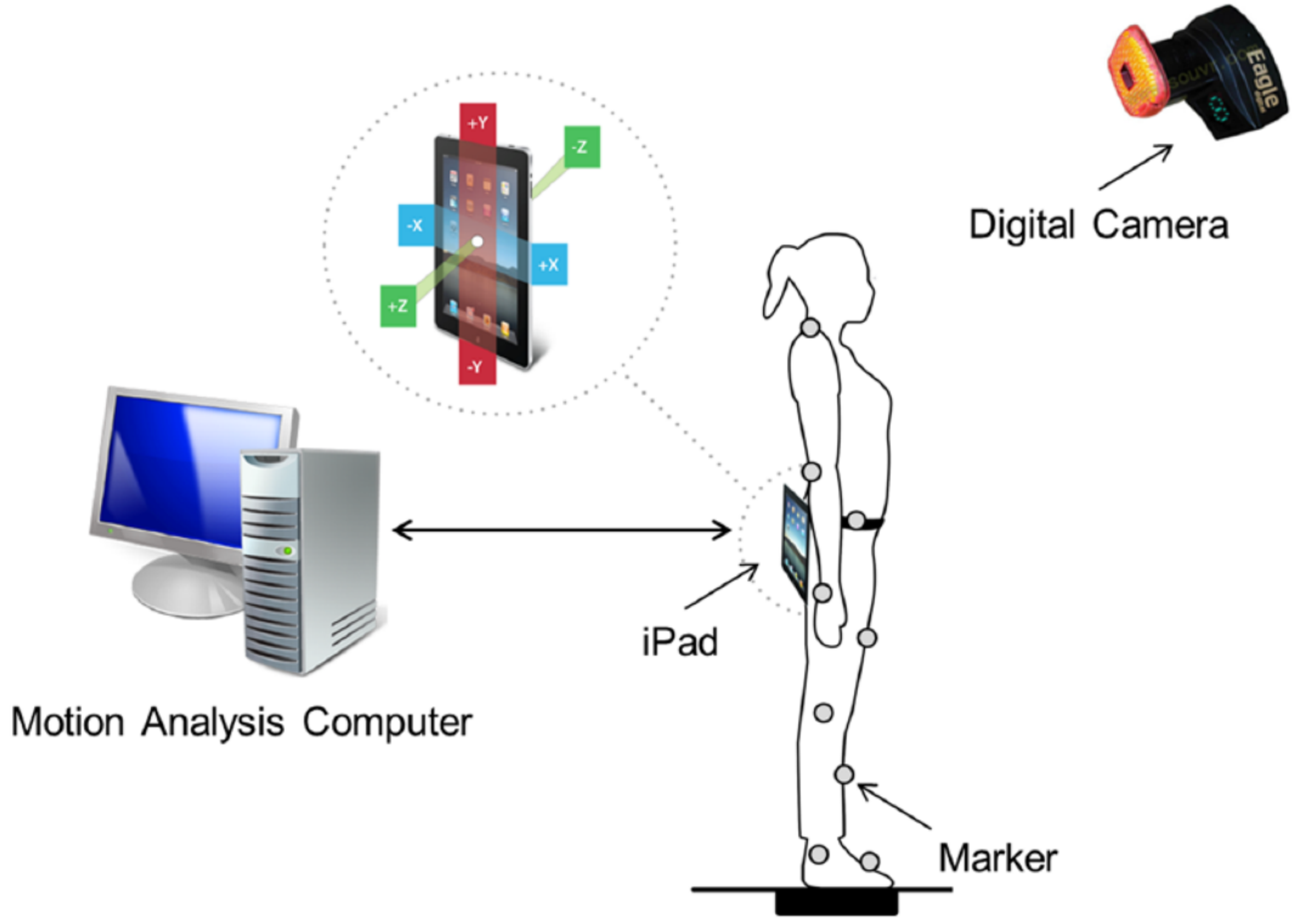
Accelerometers

iPad (third generation)

Ozinga et al., 2014

Accelerometers

Fig. 1 Illustration of experimental paradigm and measurement setup



Accelerometers

Samsung Galaxy II

Zhang et al., 2014

Accelerometers

measures

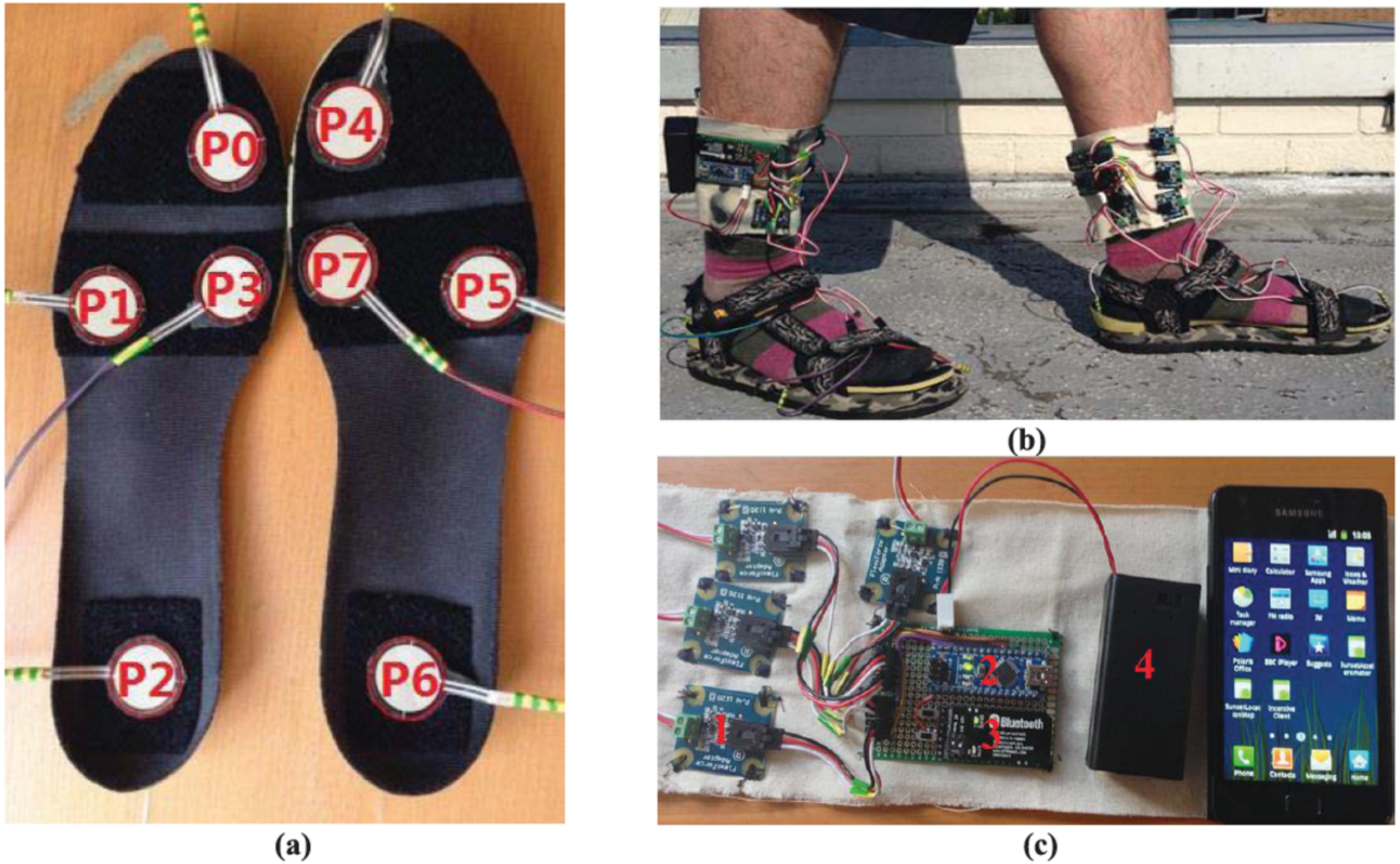


Fig. 2. Experiment equipment: (a) experimental insoles with 8 Flexiforce sensors instrumented; (b) the scene of foot force measurements; and (c) the foot force sensing system and a Samsung galaxy II smart phone.

Accelerometers

measures

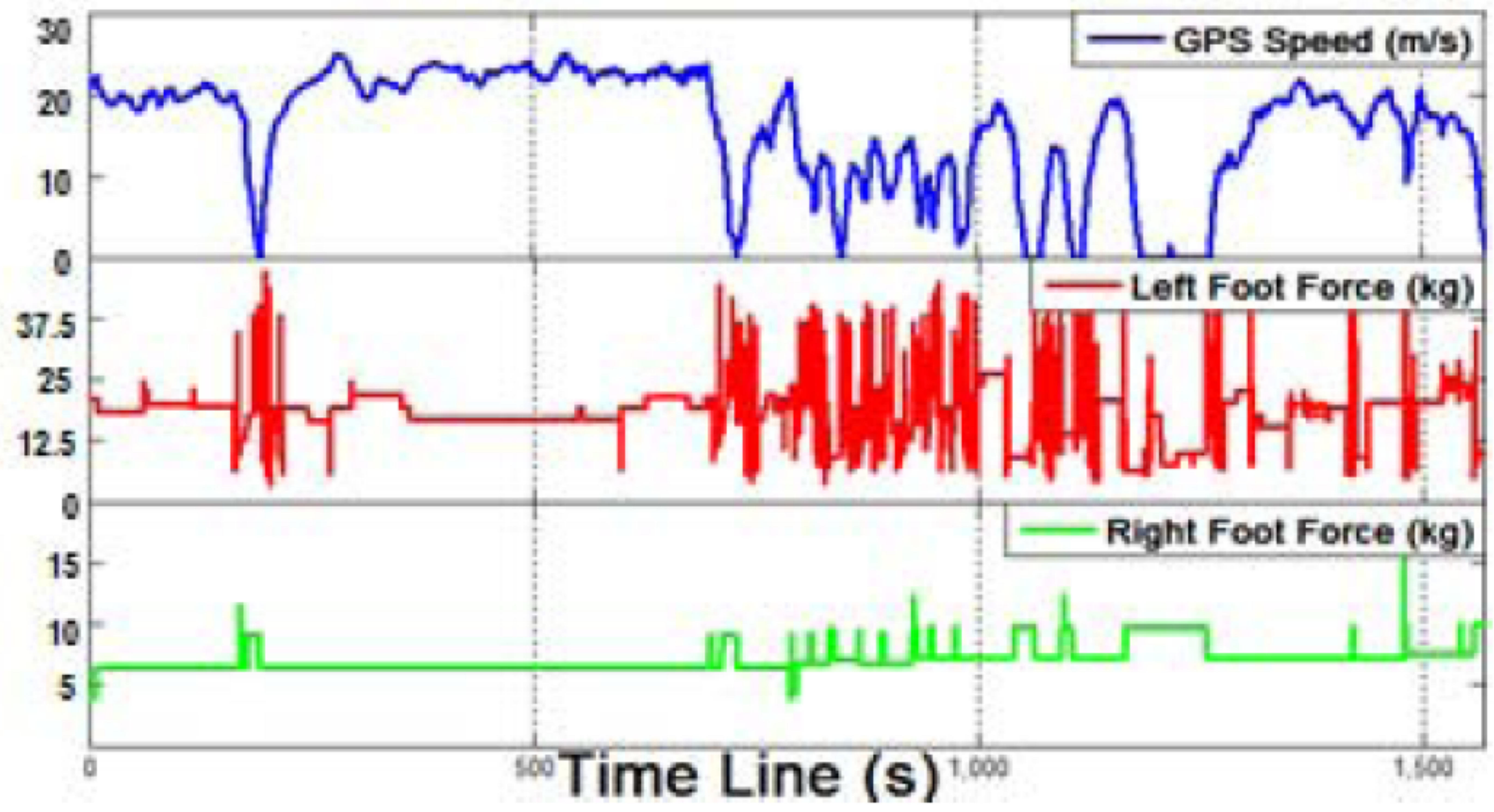
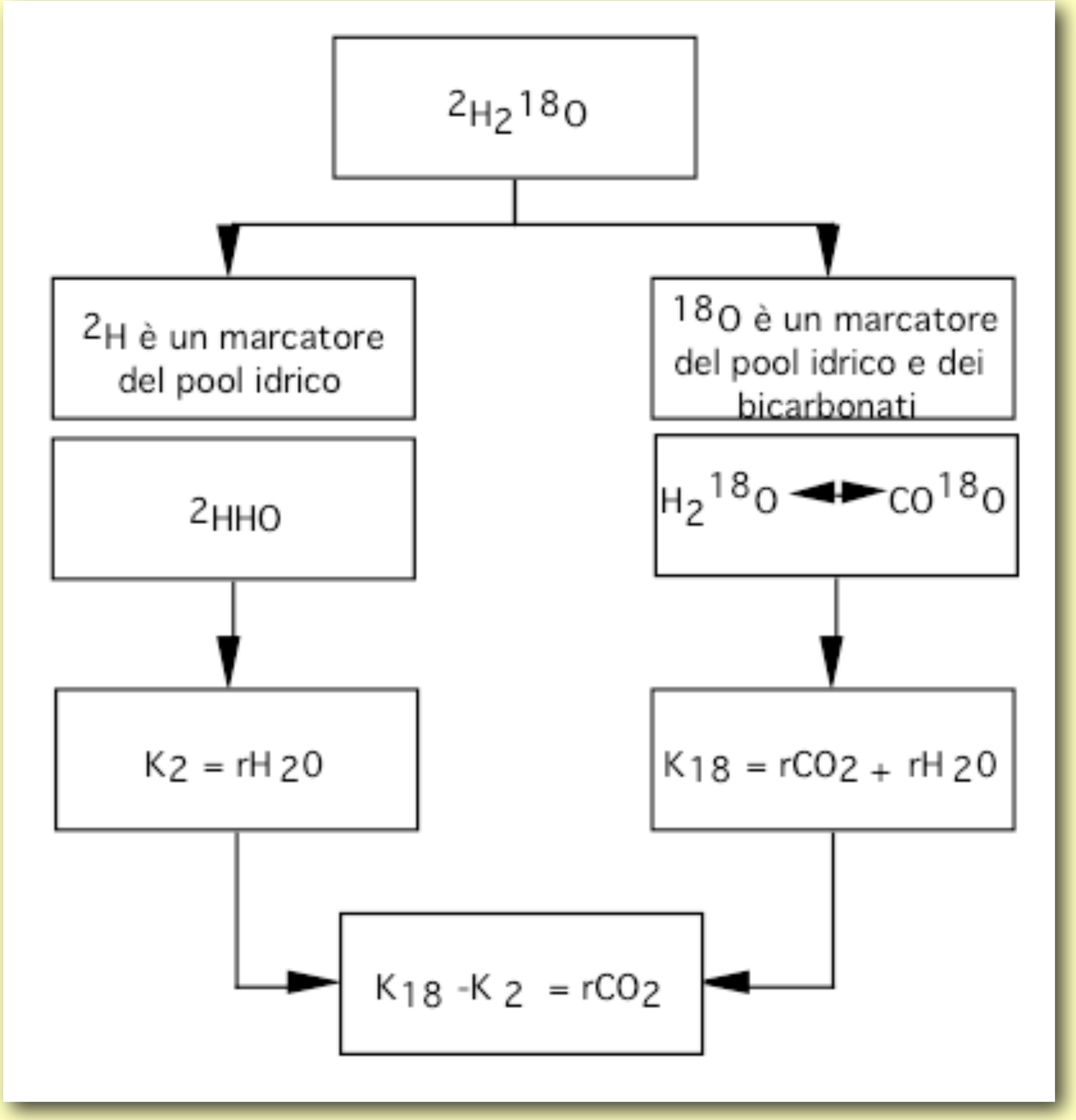


Fig. 8. GPS speed, foot force variations during a 30 minutes driving process.

DLW method

- Lifson et al., 1955;
- (small animals) 1975;
- validation by Scholler et al., 1982;
- (premature infants, children, pregnant and lactating women, elderly, obese people, hospitalized patients);
- subject is administered a dose of stable isotope $^{2}H_2{}^{18}O$, which (^{2}H, ^{18}O) equilibrates relatively quickly with body water (H, O);
- ^{2}H is eliminated as $^{2}H_2O$ (breath, urine, sweat, perspiratio insensibilis), while the ^{18}O is eliminated either as $H_2{}^{18}O$ (breath, …) and as $C^{18}O_2$ (breathe only);
- difference between the two rates of elimination -> V'CO2 -> ME

DLW method



2H2 18O
2H è un marcatore del pool idrico
18O è un marcatore del pool idrico e dei bicarbonati
2HHO
H2 18O CO 18O
K2 = rH 20
K18 = rCO2 + rH 20
K18 -K 2 = rCO2

DLW method

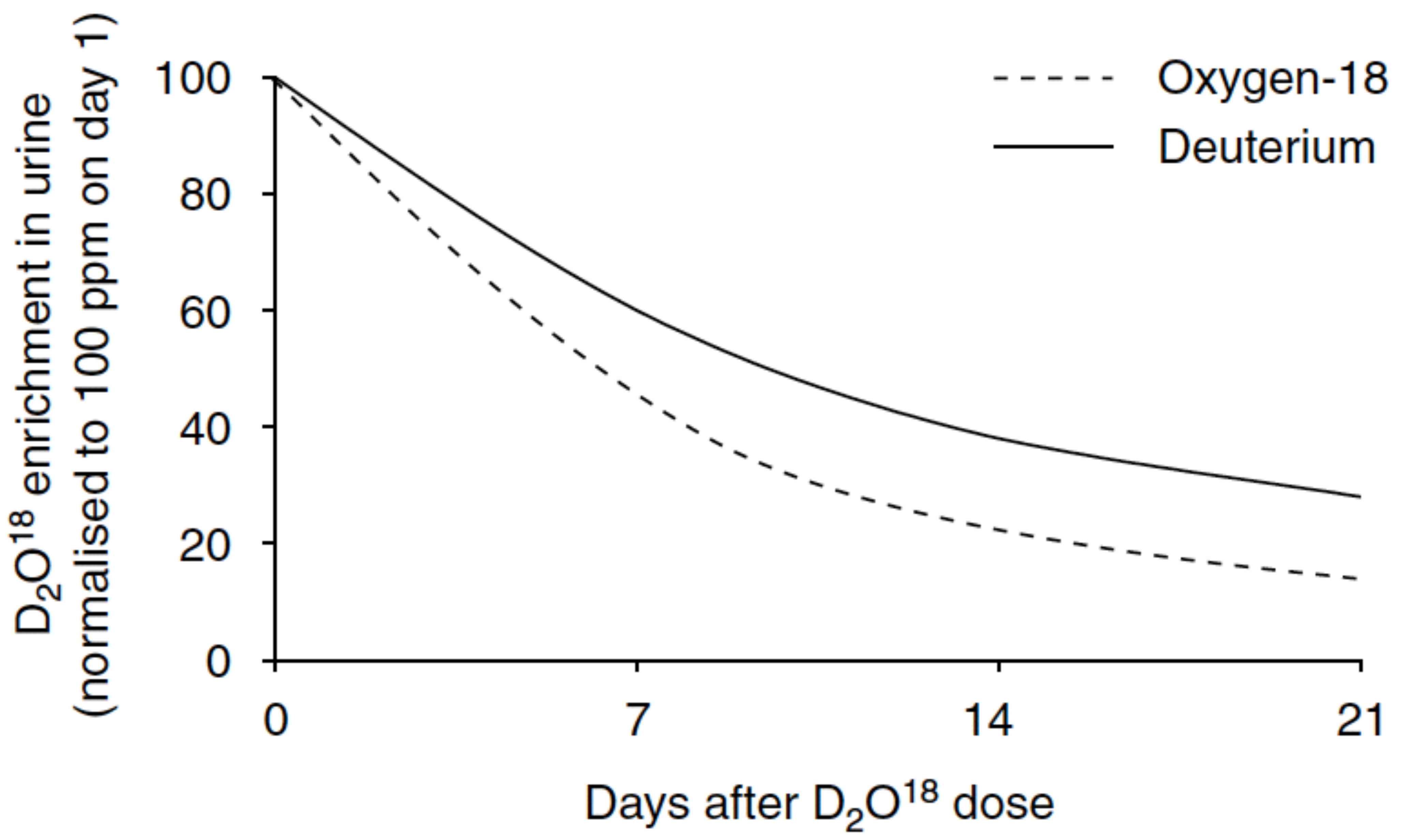


Fig. 1. Decline of ^{2}H (deuterium [D]) and ^{18}O in body fluids (urine, plasma or saliva) during a hypothetical doubly labelled water experiment.

DLW method

- RQ (= $V'CO_2$ / $V'O_2$) estimate -> accuracy:
    - . standard Western diet -> RQ estimate;
    - . food intake diary -> RQ estimate (i.e., food quotient ≈ RQ);
    - . indirect calorimetry -> RQ

DLW method

DLW method issues

- inability to discriminate the contribution of individual PAs (types, amount, intensity of each type) to ME;
- costs: isotopes and tools to detect them (i.e., mass spectrophotometers) still have considerable costs;
- -> only 3-4 ÷ 21 d ME;
- unknown RQ -> 5% e

DLW method

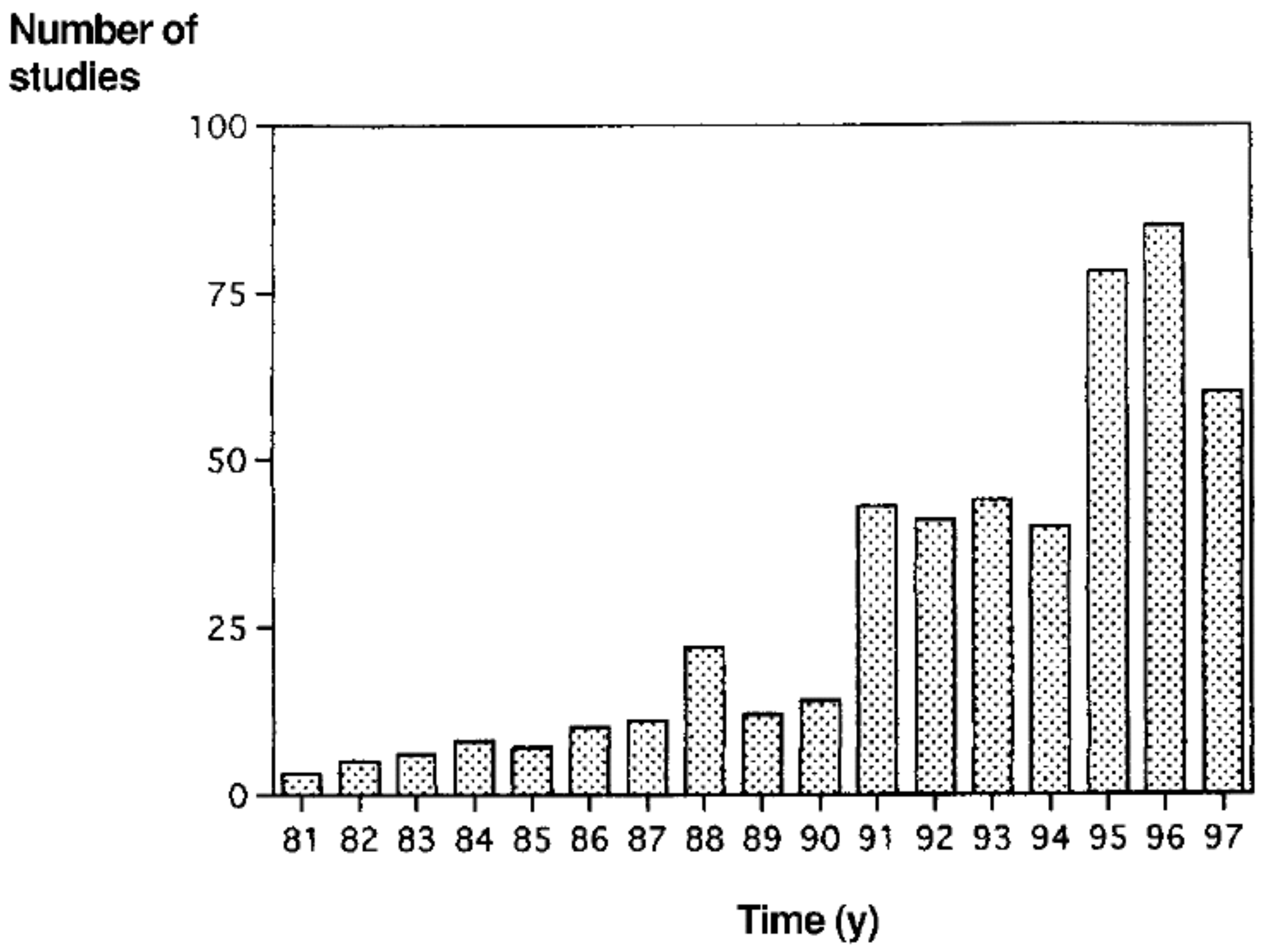


FIGURE 1. Number of studies in peer-reviewed journals (excluding abstracts) that used the doubly labeled water technique in the years 1981–1997 (through June) from the *Science Citation Index* (Institute for Scientific Information, University of Aukland, New Zealand). Since the first study in humans in 1982 the use of the technique has continued to grow.